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Oral history interview with Walter B. LaBerge  
[full name of interviewee]  
about Philco Corp. + Light Control System  
[main focus of interview]

Title: Philco Corp.  
[interviewee's current and/or former title and affiliation]

Interview conducted by Robert B. Murrie - Staff  
[interviewer's name/position]

Historian at ~~HSE~~ Philco Corp  
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**Philco-Ford Corporation**

W. B. LaBerge  
Vice President-Electronics Group

Tioga and C Streets  
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December 4, 1968

Dr. Robert B. Merrifield  
NASA - Manned Spacecraft Center  
Houston, Texas 77058

Dear Dr. Merrifield:

I have made a few line-by-line corrections on the enclosed, but have not bothered to do a complete editing and rewriting. I assume that you can make sense out of what I am returning and you are surely free to use all of it rather than delete any specific portions. I ask only that you exercise the normal prudence in insuring that the context of the remarks is maintained. In this case, I don't believe that there will be any hurt feelings. You might, however, clear whatever you write with Chris Kraft.

I am sorry for having been so long in responding. To be honest, I forgot about it and it was only my secretary's routine check of outstanding items which picked it up.

If you have any further questions, please feel free to ask.

Sincerely yours,

W. B. LaBerge

enclosure

Interview with Walter B. LaBerge  
7/31/68

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When Project Apollo started, I was at the Western Development Laboratories of the Philco Corp. The WDC had developed the network for the experimental flights at Vandenburg which the Air Force was then just starting. This relevant experience provided us with the background which enabled us to win a small study contract with John Hodge and his organization, within Flight Operations. The study had to do with flight control and information flow requirements for the Apollo missions. It was a human engineering study primarily of the way by which a data processing and display system could provide information so that the flight controllers could direct the mission. The contract was run out of Palo Alto with a large liaison staff in Houston. MSC was then located in the Southeast part of town in a number of different buildings. The study contract started in April 1962. It had an initial phase which, in a typically human engineering fashion had the usual line diagrams--blocks, circles, and diamonds which indicated who made what decisions, and what information did they need to have to make the decision, and where was the information going to come from. All this was carefully gone over with the MSC people because they, in the end, had to decide how they were going to organize themselves and all of the information flow essentially depends on the prior judgment as to who is going to do what. Given this philosophical question of how would NASA run itself, we pasted together a study which in the end was indefinite because no one had decided the level of the computational power which was going to be available. The necessary things for defining it are the people assignments and roughly what kind of data processing system there will be, - given that, then it is possible to figure out how to hook



it up with the hardware and software.

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About half way through, the study was oriented toward the physical description of the way NASA wanted to do things. Before the study was over there was a rough general outline of what MSC wanted to do for Apollo, based fundamentally on a decision made by NASA that they would use the same organizational layout of responsibilities in Apollo that had been used in Mercury. There would be a central flight controller and he would have the various sets of people with the responsibilities delineated within the same way that they were in Mercury. This was important and was the major constraint on our design, in the sense that Philco could suggest fairly simple ways that the people could be reorganized and the machinery somewhat simplified. In doing this however, there would be a loss of continuity of experience that came out of Mercury both in the way the people worked together informally and the formal set of responsibilities that they had organizationally behind them. For example, if one is going to come in and design a command control system for the Army, one doesn't reorganize the Army; one has to assume that the same set of standards are going to apply, as opposed to reorganizing the whole place. This then meant that by fractions the various sets of people in the medical system areas defined what their requirements were, the flight dynamics people defined their, the vehicle systems people their, etc. What one essentially did was to do it the way it was done in Mercury. This is probably the principal difficulty that Philco and IBM had in the sense that they had to force fit the hardware into the prior Mercury circumstance. It was a major bother to me, but subsequently

I completely reversed my position and believed that it was the only way it could have been done properly. <sup>77</sup> Having built the system for Gemini rather than Apollo, and the Gemini program had been inserted between Mercury and Apollo, I find myself and my people arguing to do it the way we did in Gemini. I roll on the floor laughing because that is the position NASA ultimately took with us. In all arguments they wanted to do things the same way they did in Mercury and quit arguing about it. Ultimately I got my people to doing the same thing - saying that we are going to do it the way we did it in Gemini, and quit arguing about it.

<sup>777-V</sup> Given that and the ability of the NASA to <sup>fund</sup> ~~support~~ a major computational complex like the system which ultimately went out on bid, the only other major problem was to define the rules of the remote sites and the Center itself. Given the state of the computer technology, there was within the NASA a reluctance to put the whole system under automatic control. So we went to a hybrid arrangement to have both flight controllers <sup>at</sup> ~~on~~ the remote sites and also flight controllers in the Center. We could, and in fact have, now that the technology has progressed, gone to a more automated operation than was done initially. This was essentially a safety measure. It was a safety device in the sense that there was a personnel interrupt capability along the chain and also a safety device in the sense we didn't have to bet our whole shirt on the fact that contractors and NASA would be able to work out all the details. Essentially it was a manual backup system at the remote site.

<sup>73</sup> At that point the NASA went out on RFP for the computer complex for the IMCC and for the digital command system, <sup>each</sup> ~~which~~ was on a separate RFP. <sup>also</sup> The communication switching complex was put out for bid. In sequence the computer piece was done first and won by IBM, primarily I believe, on their

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experience developed on the Mercury program. And that itself constituted a fair problem in the general procurement cycle, because IBM was thoroughly locked up and yet a number of the contractors including ourselves put a great deal of effort into arguing the technical merits of the individual computer product lines they had. But in the end it was primarily, I believe ~~it was~~ the programming ability and the confidence <sup>of NASA</sup> in the programming ability that secured the contract for IBM. The RFP for the control center was submitted in December 1962 by a number of contractors including RCA, ITT, Lockheed, and ourselves. The scope of the work was fairly well defined in terms of the hardware and less well defined in terms of the software interface responsibilities. This constituted the major problem that had to be solved--who could tell who what with respect to the interfaces that existed. However, the RFP had pretty well defined the typical groundrules, so that it was possible to respond to the proposal reasonably. and I it was page limited. Almost everybody including ourselves guessed that the reviewing team would be predominately knit-picking in the detail. Therefore a management gestalt was not required, but instead as much detail as possible, which then made the page limitation fairly difficult. This in turn led us to use almost no borders or margins on the pages and some of the other companies either phot<sup>o</sup>-reduced theirs or ~~they~~ used type so small that it could be read only with a magnifying glass. Subsequently, NASA's page-limited RFP's came out specifying the size of type and the size of the margins. Then everybody went to extremely complicated diagrams and very, very small print and the proposals are dreary in the extreme to read because everybody was concentrating on getting bulk information into ~~it~~. them.

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What Philco proposed to do was to put together how the resources of its

major divisions, ~~and~~ <sup>T</sup> these included the Aeroneutronic Division which for the Army had been doing the ARTOC system which was a presentation of Army field positions on detailed maps, ~~and~~ <sup>st</sup> had a great deal similarity in technology because there was the requirement to superimpose dynamic data from the computer with standard reference data which NASA had available but which was too large in quantity to permit being stored reasonably in a computer. There needed to be some way of mixing systems of data together so the Aeroneutronic ARTC was reasonable. The Communication Division in Philadelphia had the experience of having put together military communications system and their background was brought to bear in that fairly major section which is now the communications handling area. The WDL division was the prime division because of its experience in the implementation of systems as large as this one. We had supported the Air Force in this general area. The Tech Rep Division, which had been supplying the flight controllers, was a field service group which was to be called upon to do the actual installation, test, and checkout. The company as a whole scrounged up its entire programming computer resource in order to be able to define the computer hardware interface. We wrote the proposal, priced it, and submitted it. Although the program guide had said MSC did not anticipate a contractor presentation, NASA did have a review and had all the contractors give a one-hour oral presentation. As we understood the scuttle-butt at the time, NASA was polarized into two groups--a pro-IBM group which wished to have the primary responsibility for the control in the IBM hardware and consequently less emphasis in the procurement than under evaluation. An anti-IBM or an anti computer group did not wish to have the prime contractor be the computer contractor. It was much like being in the Coliseum just before they turn the lions loose. Everybody sat in tiers of chairs ringing the speaker and they all looked as if they had their

thumbs parallel--ready to turn them down.

When we did win the proposal, we started to bring people to Houston in about Feb. An essential portion of the proposal had been the time schedule and the ability to rapidly implement. We had claimed in our proposal that we could assemble 250 people within a month and have at the problem.

274 I had thought this was one of the more useful portions of our proposal. It turned out that this scared <sup>NASA</sup> ~~the~~, as they didn't wish to turn on a direct response to the RFP, but rather to work out an arrangement with the contractor as to what they really wanted and have a relatively slow turn on. 277 We spent about 4 or 5 months negotiating the details of what was meant by each of the individual areas getting work statements for each piece of the system seemingly in excruciating details. As a financial contractual arrangement, it caused my management great concern because we were operating without a contract in an area that was very rapidly redefining the whole program and evidently had no necessary correlation to the cost bid even though it was a CPFF contract. The ability to perform to the original budget was obviously in question as we began to redesign the whole works. As it turned out this was the way it should have gone; however it was pretty agonizing while getting it defined. The NASA people wanted a contractor to guarantee to do the whole job, but they had not enough working experience to trust that contractor to make intelligent impartial decisions as to the source of hardware and things of this sort. Relations deteriorated significantly, and in fact got to the point where for the first time in my life I was called a crook. I didn't feel that I was, and we had several meetings that sounded much more like labor/management meetings trying to negotiate a labor contract than they did close technical rapport.



This strain was intensified by an internal organizational squabble within NASA which subsequently was cleared up. The problem was that the MCC user was Chris Kraft. Kraft was both able to, and anxious to, dominate what was going to be provided him. He had worked with the majority of the people in the study contract and knew them. Chris wanted to work directly with these people. Yet, another MSC organization, a program management office, had been set up under Barry Graves. Graves was the <sup>EVERS</sup> ~~tinker~~ in the ~~tinker-to-tinker~~ <sup>Tinker-to-</sup> Evers-to-<sup>are</sup> chance arrangement ~~of direction through Chris~~. This was a real problem that NASA had internally as to understanding who was in fact running both IBM and ourselves. The situation was ultimately solved by Jim Elms, who redefined the roles, essentially disestablished Barry ~~and~~ <sup>who</sup> subsequently ~~he~~ went to Langley, and gave Chris the authority to go ahead and run it.

As seen from the contractor, the presumption was that the contractor was wrong until proven right on the part of Barry and the presumption on the part of Chris that he was right till he was proven wrong. It is a fundamental difference, although it is possible to make both systems work. Chris even with his more pleasant approach had the contractor much more on the hook, because it was clear that the contractor had no way to run if what he had decided to put together <sup>something that</sup> wouldn't work. Where each individual piece is defined by somebody else, the contractor always has the emotional out that he is a slave in the system and why bother him with whether or not it really works. <sup>One difficulty</sup> ~~It~~ was primarily due to the fact that Philco did not have the position of knowledge that the NASA people had. The first number of things proposed had in fact some glaring errors in them which were picked up by the people that had the experience, and this thing intended to polarize the NASA people under Barry into believing that

we were pathologically unable to do anything right. I truly admit there was plenty of support to the belief, but at any rate the thing that made Chris look pretty good coming out of it was that by the time that management had finally gotten around to making a change we had through ill feelings or good (and they change from day to day and there were many good days and also a number of bad days). We had worked out most of the problems. By the time the management changed it didn't have to solve nearly as many problems as there were on the docket originally. <sup>The job</sup> ~~It~~ was in a position to go at that time, pretty well. I still feel Paul Vavra is a good friend. However, Paul and I had probably as many arguments as reasonable people can have. Ed Odenwalder also, I guess at various times felt pretty much emotionally involved.

There were in addition <sup>also</sup> ~~too~~ areas of omission in the Philco system, principally because we had not participated in Mercury. In addition to this there were questions as to technical judgment. <sup>There</sup> Were certain items, for example, <sup>where it was judgmental as to whether they could</sup> ~~able to~~ be developed or not, in particular the selection of the ~~General Dynamics Charactertron~~ display system. This was probably one of the biggest arguments we had. The question was fundamentally whether a system which was technically less flexible and considerably more expensive, but available, should be used in preference to a conceptual design which was within the state-of-the-art but which hadn't been developed--namely a digital TV system. Subsequently the digital TV was developed with considerably more strain in time than the original schedule would have permitted, which left Paul Vavra confident that his decision was right in that the digital TV was harder than we had expected, and left me believing he was probably right but surely had we had to do it, I believe we could



have forced the thing to have gotten it done. In the absence of not having done it, you can't tell whether it could have been or not, but that was <sup>the kind of</sup> ~~probably a~~ technical question that existed, and NASA <sup>usually</sup> chose the conservative position.

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Philco wrote the specifications for the technique for using the communications processor which subsequently led to essentially the definition of what the Univac machines were. Philco also worked with NASA in specifying the requirements for the digital command processor which subsequently was won by Radiation in an open procurement. In each of the hardware areas there were specs developed well beyond what we would normally do with the customer and interminable **wrangles** about the details of the specs. It led, however, to the most unusual implementation I have ever seen. Namely every thing came together like motion pictures of an explosion run backward. It all went together and the specs had been so thoroughly worked over that in fact they were in no appreciable difficulties in making the whole system hang together. I have never had the experience of one going together as easily as this one did that had as many pieces, ~~and~~ this was undoubtedly due to the excruciating details we went through, somewhat involuntarily because of the NASA pressure. NASA has a thoroughly competent set of people who in the early stages made it appear exceedingly difficult for the contractor because his flexibility was essentially zero. Because of the people he hired he got a run for his money in terms of arguments and the net result was very good.

Finally all the specs got written and signed out by everybody in the place and got put out and it was a crash program to meet the GT-4 schedule. Our contractual date was somewhat delayed but also the GT series had slipped, so we were able to bring the thing in to where it could support the flight.

There was a real question as to what the fundamental requirement of the contract was--whether it was to provide the hardware and interconnect it or whether it was to successfully pass a flight support. Fortunately this didn't get to be crucial contractual difficulties because the thing did go together and did support GT 4 pretty well. In the process, I think all of us recognized the major opportunities in simulation that derived from the hardware which was then being defined. Since the control of the flights was a shared responsibility with the astronaut, the reaction to emergencies and the techniques for control were all worked out in the simulations.

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The total number of major emergencies ~~that~~ have not been covered by ~~simulations~~ in the Gemini series was something like 2 or 3 out of 35.

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The whole simulation program was of profound importance. It was so good a simulation by the time everybody contributed to it that you could see the sweat on the brows of the people and their hands would get clammy just running the exercises. There are some stories how, for example, Grissom had decided to eject one day and Chris had told him don't and Grissom did and this defined who had what responsibilities during the ascent phase.

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As another simulation, Chris apparently aborted the mission without knowing it and the tapes had to be played back to make sure everybody else was right and Chris had in fact aborted the mission. The constant practice through the simulation made the missions themselves seem to be almost routine. Even the emergency had the appearance of just having happened two or three times before--a fabulous working out of the responsibilities of the ground controllers and the astronauts through simulation process.

During all of this time we had - as one would normally expect - a fair amount of contest of will between ourselves and IBM people for the large fertile ground that lay between their hardware and our hardware, which was the software specifications area. Each had staffing problems, and nobody was clean as far as whether they had all done their <sup>prime</sup> jobs particularly well. I remember the meeting we had with Gilruth and Chris and some of the people from Washington in a progress report where I had described the Philco schedule position where we had an integrated schedule with IBM. I turned to Jim Hamlin and asked if he was going to be on schedule as we were. I thought I had said it in a conversationally pleasant way, and his response was "we'll beat your ass off." In a meeting of this kind, it caused a 30 second hiatus, and me to fumble over what came next.

In point of fact, the IBM people were extremely competent. They had a massive job to do as well as we did, and we probably got along better than one could expect. NASA sort of refereed <sup>d</sup> the interfaces, and clearly there were very many fundamental questions of how we tied together because we had a completely computer directed command and control system. Although there were separate pieces of machinery the organization of the system was one basic system. The relationships with Univac and the Radiation people were good and I think on the whole the relationships with the NASA people were pretty good. We did have considerable question about the propriety of NASA influencing as much detailed control. But MSC technical competence was, in the main, just excellent.

From Philco's standpoint, I think we did a pretty competent job. We had the staffing problems that one might expect getting people to come to Houston, although no different really from what the NASA people had themselves.

It was thought to be about the world's worst place to live. After we once got our staff down they all enjoyed it, but getting them to come initially was a pretty difficult task. The impression that Houston is the end of the world had been generated primarily by people's experience with Ellington during the war, and Houston as it was during the war at which time it was a totally different town. We have far more identification with that area by our people now than exists among the Palo Alto or Philadelphia groups. There was a massive conversion later, but that didn't help much with the problem getting people there initially. We did draw people from all of the individual divisions and put them together in a way that the company had never done before. The company had frequently supported its other divisions but it never really put together a "purple suit" team like this from all parts of the company and made it work. Undoubtedly the major reason that it did work was the obvious national interest in the program, and the fact that the company and all of its individuals were committed to make it work. Our problem was not radically different from IBM or any of the other people. This amorphous organization was put under one manager. Complete financial control was retained in Houston. That again was probably the only way it would work. Just bringing people in on temporary assignment could not have been made to work, but by making them permanent and tied to the success to the program people they did get the identification necessary to make it work.

Probably the fundamentally most useful thing Philco did during the period of hardware concentration was to force a set of people together who could work on the software end of the business in defining procedures, in writing software requirements for the computational system, in defining what the formats and displays would be, and the general process by which they were used. This was a necessary piece of work, which by forcing at that time,

we probably got a great deal of the business that IBM could just have easily have fallen heir to or NASA could have gotten another contractor to do. This business is the main area of revenue to us currently. We have the hardware in this area and there is some hardware support, but the provisioning of the flight controllers which we do and the support tasks in defining mission requirements in hook-up of the system is what most of our 500 people do outside of the Bldg 30. The other one-half of our kind of business is the current support to the maintenance and operation. The tech rep division did an outstanding job in getting people assigned from all over the world to do the support in the installation and checkout and subsequently in the operation and maintenance. The incentive scores show that they have done a first class job. In the main, NASA is bound to be happy if the support goes well and bound to be unhappy if it goes poorly. The critical requirement then and now for maintaining our position is support to the flights. This is the one which frequently gets the least attention because it is the least interesting. NASA has the real flight control and what Philco does is maintain the hardware, bring it up to date, modify it, and see that it's all hooked up right. One can argue that this is a fairly pedestrian task. As it turns out, we can get good people and keep them interested because of the kind of programs that are being run. Really the key to our ability to maintain the people is not our incentive management, it is the fact that we are doing rendezvous and are getting ready to go to the moon and the people want to be a part of it. I don't believe we could have maintained or can maintain the level of competence that we have through whatever ingenuity we have except for the fact that there is this kind of test program going on. In fact it represents a major problem to NASA in its organization and also in ours when there are long hiatuses between flights, or the long period between

Gemini and Apollo. The capacity stays together only if it is doing something that is interesting. Reoccurring hardware is not that interesting - supporting flights is what is interesting. Philco has a major blessing in that it could draw people from the past flight support of the Air Force programs and out of the Mercury program.

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306-1 We had much more of a transient management than what NASA has had, primarily because the rule has changed very significantly from what was a hardware definition, procurement and integration task to a flight support task. We were forced to bring in the kinds of people who could integrate hardware systems and they turned out to be lousy with respect to long-term flight support, and for our own self protection, we moved a number of them out. They are the kind that would argue day in and day out as to what is the best technical design and go all out to conquer the world. In the long term, this is not the kind of people we needed to make it run. We needed and got people who were more operations-oriented and less hardware oriented.

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305 Dr. O. G. Schuede was the Chief Engineer during the early portion of the program and he and Dr. Frank F. Cartwright were the primary people responsible for the hardware definition phase and the key technical people in the definition of the system. Bob Benware took over Philco's Houston operations at the time of GT-4. In the communications area, Don DeWitt was the primary communications man. John <sup>Poloneimi</sup> ~~Polonieny~~ directed the simulation systems. Herb Hendrickson had the display system. Bob Cronhardt had the responsibility of making sure that this system was integrated, and probably <sup>correctly</sup> and that about 4.5 million wires laying on the floor were put together right ~~as well as insuring that the whole scheduling and testing program went correctly.~~ In the software support area, Dr. Lepine initially started the work.

347-2 During the period just before I left, we had begun discussions with MSC about the proper way to measure performance. We agreed with MSC that an incentive program would be desirable for both of us. At least one half of the scoring was <sup>to be</sup> subjective. In the end it was how the people felt about us that would set in the back of their minds as they evaluated the numbers. This worried us somewhat because it was unilateral with respect to the scoring. However, knowing Chris and John Hodge, and the contracts people, and having worked together a couple of years we were willing to have a go at it. It seemed to work so well that later we suggested to the Air Force that they consider this technique for scoring an evaluation of our performance in the worldwide network that we operate for them. Incentive programs are very difficult when they are subjective unless you have had some operating experience with the people. <sup>HA</sup> Our technical capacity that we brought to bear was built up out of the work we did for the Air Force. In that sense NASA bought that prior experience. As the Air Force in turn has gone toward larger computer control of its network, it has had the benefit of being able to visit NASA, review specifications, etc., and also by having the advantage of NASA experience of Philco in updating the Air Force technology. The technologies are very similar and it is possible to trace the technology back and forth--

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277 We had about 150 people by the end of the third month in Houston. I purchased a house on the west side of town near the Houston Country Club and shortly after we moved in, we had a party and invited all of our people and a number of NASA people, including John Hodge and his wife, Audrey.



We had become good friends with the Hodges, and liked to kid her about the fact that she retained her British citizenship. During this party she got back at me by saying in what was actually a normal voice for her, but what seemed to carry through the whole house - something to the effect that nobody in NASA can understand why you bought such a nice house because you are not going to be here for very long -- at which point a complete quiet came over everyone, including the 150 people I had brought down there on the assumption that this was a long-term commitment. It was as if everyone stopped to listen to see what the answer was. I answered as best I could that I believed if we did a reasonable job, it would be impossible for NASA to wish to get rid of us, and I was confident enough that I had bought the house. I am not sure that this satisfied anybody and clearly set the initial tone of questioning a little bit as to whether or not it was sensible to go buy houses - move families, and settle down. Audrey blushes each time I remind her of this subject. What had been sort of a private conversation became a single question symposium.

763 We had had a history in the division before we moved to Houston of having parties and enjoying each other socially. We put one together at the end of the first 6 months in Houston. We had a series of songs and parodies which gently poked fun at ourselves and the NASA people. After the first joke at MSC's expense, everybody looked over at Chris to see whether he would laugh. Chris was rolling on the floor which encouraged others to accept it in a good spirit. Probably the most unusual thing that ever happened to me on this contract - we were holding intense discussions with IBM on the question of who was going to do what, which was made more difficult by the fact that we were all under a crash schedule, and IBM had just changed its local leadership--Jim Hamlin had been replaced by Larry ~~Saroban~~ <sup>SARAHAN</sup>. One day soon after his arrival, Larry called me and asked if my name was LaBerge? I replied in the affirmative and

304 he said he knew only one LaBirge and could I be the one? It turned out that Larry and I had grown up together within two blocks of each other in Maywood, Ill., and had been part of the same gang who threw snowballs with rocks in them at one of the <sup>other</sup> neighboring gangs. He was a couple of years older, had gone to the same high school and was a very close personal friend. Probably because of this singular factor, I was obliged to be tolerant in my attitude toward IBM and toned down our emotions a little bit. We got along much better as a result of that personal move that nobody had figured out.

304 306-1 Bob Benware took my place just prior to GT-4. Bob came from the Palo Alto division of WDL and had the responsibility for all the systems managed by the division. Bob has fairly substantially altered the staff from the one I had brought down and it is to his credit that it works as well as it does. <sup>The problem</sup> ~~because it is~~ the transition bridge <sup>between</sup> ~~again that is~~ primarily hardware oriented activity which had been the one that I had participated in and the flight support work which he has been running. The transition has gone really quite smoothly and it has seen a number of people advance because of their ability.

305 There are a couple I think particularly that should be mentioned-- Chuck Abbit has been the program manager for the last couple of years. Abbit in <sup>a</sup> ~~his~~ last assignment <sup>in</sup> ~~of~~ his military career had been the DOD rep down at the Cape. He had experience in the <sup>Mercury</sup> ~~Gemini~~ program and was known to Chris and his people. He joined Philco when he retired from the service and has been the program manager for the last several years. He has done an excellent job of making sure that the two organizations mesh well in a fruitful way. Ed Brown should be mentioned as he is the primary man responsible for the software <sup>Planning</sup> support. He also came out of the Cape Kennedy

complex, and for the last several years has had the major responsibility for all of the direct software support. George Straty who is primarily responsible for the programming for our simulation computers.